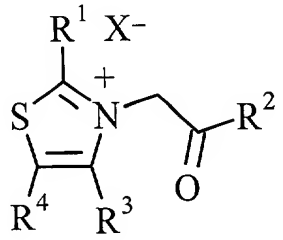
What is claimed is:

1. A composition for the treatment of hair, nail, ex-vivo organ, ex-vivo cell or ex-vivo tissue to improve the biomechanical and diffusional characteristics comprising an effective amount of a compound selected from the group consisting of compounds of the formula (I):



(I)

wherein

R^1 is a C_1-C_{18} alkyl group, or the group $-CH(R^5)-OH$, or the group $-CH(R^5)-OC(=O)-R^6$ wherein R_5 is a C_{1-18} alkyl group and R_6 is selected from the group consisting of C_1-C_{18} alkyl, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl and naphthyl;

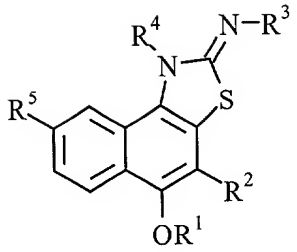
R_2 is selected from the group consisting of hydroxy, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl, a C_{5-7} aromatic, unsaturated or saturated heterocyclic ring having one to three heteroatoms selected from the group consisting of N, O and S;

R_3 and R_4 are independently selected from the group consisting of hydrogen, C_1-C_{18} alkyl or hydroxyalkyl, or phenyl, or R_3 and R_4 together are a bridge of 3-6 methylene units, or R_3 and R_4 together with their ring atoms may be an aromatic ring system of 6-10 carbons, optionally substituted with one or more halo, lower alkyl, lower alkoxy, or amino groups; and

X^- is halide or other pharmaceutically acceptable anion.

2. The composition of claim 1 wherein the effective amount is sufficient to return the biomechanical and diffusional characteristics of the hair, nail, ex-vivo organ, ex-vivo cell or ex-vivo tissue to the state found in a healthy 20 year old human.

3. A composition for the treatment of hair, nail, ex-vivo organ, ex-vivo cell or ex-vivo tissue to improve the biomechanical and diffusional characteristics comprising an effective amount of a compound selected from the group consisting of compounds of the of formula (II):



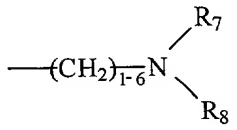
(II)

wherein

R^1 is selected from the group consisting of H, C_{1-5} lower alkyl, C_{1-18} lower alkanoyl, and aroyl;

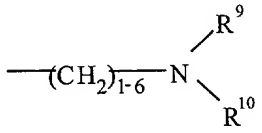
R^2 is selected from the group consisting of hydrogen and C_{1-5} lower alkyl;

R^3 is selected from the group consisting of lower alkyl, C_3-C_8 cycloalkyl, phenyl, 1-[(aminoiminomethyl)hydrazono]ethyl substituted phenyl, naphthyl, or aminoalkyl of the structure



wherein R^7 and R^8 are independently selected from the group consisting of hydrogen, C_1-C_6 alkyl, C_1-C_6 hydroxyalkyl, or R^7 and R^8 taken together with the nitrogen atom form a C_4-C_7 heterocyclic ring optionally containing one or two additional heteroatoms selected from the group consisting of N, O or sulfur;

R^4 is selected from the group consisting of methyl, lower alkyl, or aminoalkyl of structure



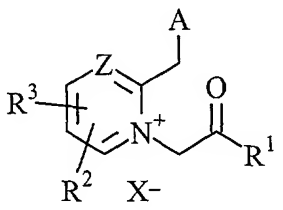
wherein R^9 and R^{10} are independently selected from the group consisting of hydrogen, C_1-C_6 alkyl, C_1-C_6 hydroxyalkyl, or R^9 and R^{10} taken together with the nitrogen atom form a C_4-C_7 heterocyclic ring optionally containing one or two additional heteroatoms selected from the group consisting of N, O or sulfur; and

R^5 is selected from the group consisting of hydrogen, acetyl and 1-[(aminoiminomethyl)-hydrazono]ethyl;

or hydrochloride salts thereof, or other pharmaceutically acceptable salts thereof.

4. The composition of claim 3 wherein the effective amount is sufficient to return the biomechanical and diffusional characteristics of the hair, nail, ex-vivo organ, ex-vivo cell or ex-vivo tissue to the state found in a healthy 20 year old human.

5. A composition for the treatment of hair, nail, ex-vivo organ, ex-vivo cell or ex-vivo tissue to improve the biomechanical and diffusional characteristics comprising an effective amount of a compound selected from the group consisting of compounds of formula (III):



(III)

wherein A is hydrogen, cyano, or a C_6-C_{10} aryl group, said aryl groups optionally substituted by one or more lower alkyl, lower alkoxy, or halo groups;

Z is CH or N;

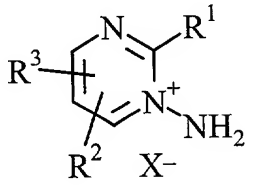
R^1 is hydroxy, C_1-C_{18} alkoxy, amino optionally substituted with 1-2 independent C_1-C_{18} alkyl groups, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl, or a C_{4-7} aromatic or unsaturated or saturated heterocyclic ring having one to three heteroatoms selected from the group consisting of N, O, or S, with the proviso that at least one heteroatom is nitrogen and said nitrogen is directly bonded to the carbonyl group; and

R^2 and R^3 are independently selected from hydrogen, amino, or C_1-C_{18} alkyl groups, or R^2 and R^3 taken together may form a carbocyclic or heterocyclic ring, and

X^- is halide, or other pharmaceutically acceptable anion.

6. The composition of claim 5 wherein the effective amount is sufficient to return the biomechanical and diffusional characteristics of the hair, nail, ex-vivo organ, ex-vivo cell or ex-vivo tissue to the state found in a healthy 20 year old human.

7. A composition for the treatment of hair, nail, ex-vivo organ, ex-vivo cell or ex-vivo tissue to improve the biomechanical and diffusional characteristics comprising an effective amount of a compound selected from the group consisting of compounds of formula (IV):



(IV)

wherein R^1 is selected from:

amino,

methyl,

cyanomethyl,

the group $-CH_2-A$ where A is a C_6-C_{10} aryl group optionally substituted by one or more lower alkyl, lower alkoxy or halo groups, or

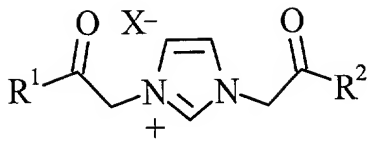
the group $-CH_2-C(=O)-Z$ where Z is selected from hydroxy, C_1-C_{18} alkoxy, amino optionally substituted with 1-2 C_1-C_{18} alkyl groups, a C_6-C_{10} aryl group optionally substituted by one or more lower alkyl or halo groups, or a C_{4-7} aromatic or unsaturated or saturated heterocyclyl group having one to three heteroatoms selected from the group consisting of N, O, or S;

R^2 and R^3 are independently selected from hydrogen, amino, lower alkoxy, or C_1-C_8 alkyl groups, or if R^2 and R^3 are on adjacent atoms then R^2 and R^3 taken together with their ring atoms may form a fused carbocyclic or heterocyclic ring; and

X^- is mesitylene-2-sulfonate or other pharmaceutically acceptable anion.

8. The composition of claim 7 wherein the effective amount is sufficient to return the biomechanical and diffusional characteristics of the hair, nail, ex-vivo organ, ex-vivo cell or ex-vivo tissue to the state found in a healthy 20 year old human.

9. A composition for the treatment of hair, nail, ex-vivo organ, ex-vivo cell or ex-vivo tissue to improve the biomechanical and diffusional characteristics comprising an effective amount of a compound selected from the group consisting of compounds of formula (V):



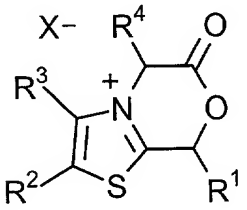
(V)

wherein

R^1 and R^2 are independently selected from hydroxy, lower alkoxy, amino optionally substituted with 1-2 lower alkyl groups, aryl, halosubstituted aryl, (lower alkyl)substituted aryl, or a C_{5-7} unsaturated or saturated heterocyclic ring having one to three heteroatoms selected from the group consisting of N, O, and S and X^- is halide, or other pharmaceutically acceptable anion.

10. The composition of claim 9 wherein the effective amount is sufficient to return the biomechanical and diffusional characteristics of the hair, nail, ex-vivo organ, ex-vivo cell or ex-vivo tissue to the state found in a healthy 20 year old human.

11. A composition for the treatment of hair, nail, ex-vivo organ, ex-vivo cell or ex-vivo tissue to improve the biomechanical and diffusional characteristics comprising an effective amount of a compound selected from the group consisting of compounds of the formula:



wherein

R^1 and R^4 are independently selected from hydrogen, phenyl or C_1-C_5 alkyl;

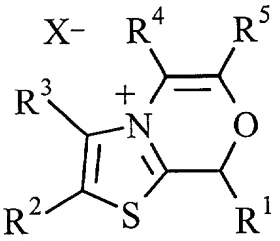
R^2 and R^3 are independently selected from the group consisting of hydrogen, C_1-C_{18} alkyl or hydroxyalkyl, or phenyl, or R^2 and R^3 together are a bridge of 3-6 methylene units, or R^2 and R^3 together with their ring atoms may be an aromatic ring system of 6-10 carbons, optionally substituted with one or more halo, lower alkyl, lower alkoxy, or amino groups; and

X^- is a pharmaceutically acceptable anion such as halide.

12. The composition of claim 11 wherein the effective amount is sufficient to return the

biomechanical and diffusional characteristics of the hair, nail, ex-vivo organ, ex-vivo cell or ex-vivo tissue to the state found in a healthy 20 year old human.

13. A composition for the treatment of hair, nail, ex-vivo organ, ex-vivo cell or ex-vivo tissue to improve the biomechanical and diffusional characteristics comprising an effective amount of a compound selected from the group consisting of compounds of the formula:



wherein

R^1 and R^4 are independently selected from hydrogen, phenyl or C_1-C_5 alkyl;

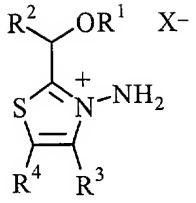
R^2 and R^3 are independently selected from the group consisting of hydrogen, C_1-C_{18} alkyl or hydroxyalkyl, or phenyl, or R^2 and R^3 together are a bridge of 3-6 methylene units, or R^2 and R^3 together with their ring atoms may be an aromatic ring system of 6-10 carbons, optionally substituted with one or more halo, lower alkyl, lower alkoxy, or amino groups;

R^5 is phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl, or a C_{5-7} aromatic or unsaturated or saturated heterocyclic ring having one to three heteroatoms selected from the group consisting of N, O and S; and

X^- is a pharmaceutically acceptable anion such as halide.

14. The composition of claim 13 wherein the effective amount is sufficient to return the biomechanical and diffusional characteristics of the hair, nail, ex-vivo organ, ex-vivo cell or ex-vivo tissue to the state found in a healthy 20 year old human.

15. A composition for the treatment of hair, nail, ex-vivo organ, ex-vivo cell or ex-vivo tissue to improve the biomechanical and diffusional characteristics comprising an effective amount of a compound selected from the group consisting of compounds of the formula:



wherein

R^1 is hydrogen, or $-C(=O)-R^6$ wherein R^6 is selected from the group consisting of C_1-C_{18} alkyl, C_1-C_{18} alkoxy, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl and naphthyl;

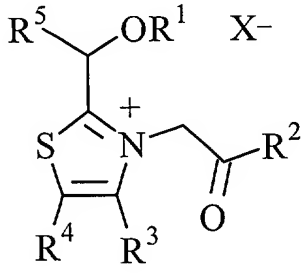
R^2 is hydrogen, phenyl or a C_{1-5} alkyl group;

R^3 and R^4 are independently selected from the group consisting of hydrogen, C_1-C_{18} alkyl or hydroxyalkyl, or phenyl, or R^3 and R^4 together are a bridge of 3-6 methylene units, or R^3 and R^4 together with their ring atoms may be an aromatic ring system of 6-10 carbons, optionally substituted with one or more halo, lower alkyl, lower alkoxy, or amino groups; and

X^- is mesitylene-2-sulfonate or other pharmaceutically acceptable anion.

16. The composition of claim 15 wherein the effective amount is sufficient to return the biomechanical and diffusional characteristics of the hair, nail, ex-vivo organ, ex-vivo cell or ex-vivo tissue to the state found in a healthy 20 year old human.

17. A compound of formula



wherein

R^1 is hydrogen, or $-C(=O)-R^6$ wherein R^6 is selected from the group consisting of C_1-C_{18} alkyl, C_1-C_{18} alkoxy, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl and naphthyl;

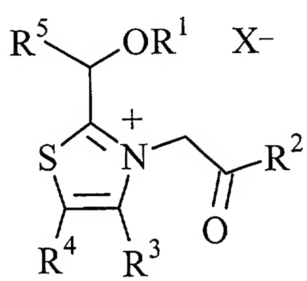
R^2 is selected from the group consisting of hydroxy, C_1-C_{18} alkoxy, amino optionally substituted with 1-2 independent C_1-C_8 alkyl groups, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl, naphthyl, or a 4 to 10 membered aromatic heterocyclic or unsaturated heterocyclic or saturated heterocyclic ring system of 1 to 2 rings having one to three heteroatoms selected from the group consisting of N, O and S;

R^3 and R^4 are independently selected from the group consisting of hydrogen, C_1-C_{18} alkyl or hydroxyalkyl, or phenyl, or R^3 and R^4 together are a bridge of 3-6 methylene units, or R^3 and R^4 together with their ring atoms may be an aromatic ring system of 6-10 carbons, optionally substituted with one or more halo, lower alkyl, lower alkoxy, or amino groups;

R^5 is hydrogen, phenyl or a C_{1-5} alkyl group; and

X^- is a pharmaceutically acceptable anion such as halide.

18. A pharmaceutical composition for administration to an animal, comprising a pharmaceutically effective amount of a compound selected from the group consisting of of formula



wherein

R^1 is hydrogen, or $-C(=O)-R^6$ wherein R^6 is selected from the group consisting of C_1-C_{18} alkyl, C_1-C_{18} alkoxy, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl and naphthyl;

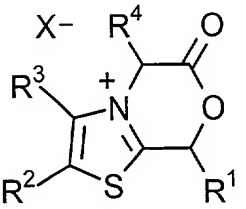
R^2 is selected from the group consisting of hydroxy, C_1-C_{18} alkoxy, amino optionally substituted with 1-2 independent C_1-C_8 alkyl groups, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl, naphthyl, or a 4 to 10 membered aromatic heterocyclic or unsaturated heterocyclic or saturated heterocyclic ring system of 1 to 2 rings having one to three heteroatoms selected from the group consisting of N, O and S;

R^3 and R^4 are independently selected from the group consisting of hydrogen, C_1-C_{18} alkyl or hydroxyalkyl, or phenyl, or R^3 and R^4 together are a bridge of 3-6 methylene units, or R^3 and R^4 together with their ring atoms may be an aromatic ring system of 6-10 carbons, optionally substituted with one or more halo, lower alkyl, lower alkoxy, or amino groups;

R^5 is hydrogen, phenyl or a C_{1-5} alkyl group; and

X^- is a pharmaceutically acceptable anion such as halide.

19. A compound of the formula:



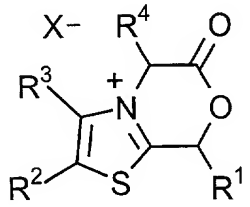
wherein

R^1 and R^4 are independently selected from hydrogen, phenyl or C_1-C_5 alkyl;

R^2 and R^3 are independently selected from the group consisting of hydrogen, C_1-C_{18} alkyl or hydroxyalkyl, or phenyl, or R^2 and R^3 together are a bridge of 3-6 methylene units, or R^2 and R^3 together with their ring atoms may be an aromatic ring system of 6-10 carbons, optionally substituted with one or more halo, lower alkyl, lower alkoxy, or amino groups; and

X^- is a pharmaceutically acceptable anion such as halide.

20. A pharmaceutical composition for administration to an animal, comprising a pharmaceutically effective amount of a compound selected from the group consisting of of formula



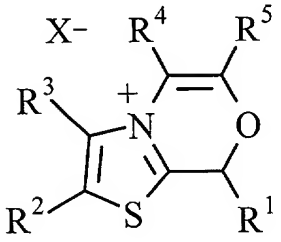
wherein

R^1 and R^4 are independently selected from hydrogen, phenyl or C_1-C_5 alkyl;

R^2 and R^3 are independently selected from the group consisting of hydrogen, C_1-C_{18} alkyl or hydroxyalkyl, or phenyl, or R^2 and R^3 together are a bridge of 3-6 methylene units, or R^2 and R^3 together with their ring atoms may be an aromatic ring system of 6-10 carbons, optionally substituted with one or more halo, lower alkyl, lower alkoxy, or amino groups; and

X^- is a pharmaceutically acceptable anion such as halide.

21. A compound of the formula:



wherein

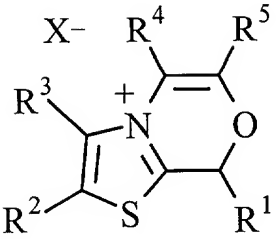
R^1 and R^4 are independently selected from hydrogen, phenyl or C_1-C_5 alkyl;

R^2 and R^3 are independently selected from the group consisting of hydrogen, C_1-C_{18} alkyl or hydroxyalkyl, or phenyl, or R^2 and R^3 together are a bridge of 3-6 methylene units, or R^2 and R^3 together with their ring atoms may be an aromatic ring system of 6-10 carbons, optionally substituted with one or more halo, lower alkyl, lower alkoxy, or amino groups;

R^5 is phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl, or a C_{5-7} aromatic or unsaturated or saturated heterocyclic ring having one to three heteroatoms selected from the group consisting of N, O and S; and

X^- is a pharmaceutically acceptable anion such as halide.

22. A pharmaceutical composition for administration to an animal, comprising a pharmaceutically effective amount of a compound selected from the group consisting of of formula



wherein

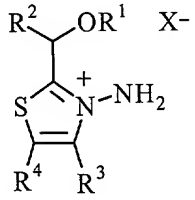
R^1 and R^4 are independently selected from hydrogen, phenyl or C_1-C_5 alkyl;

R^2 and R^3 are independently selected from the group consisting of hydrogen, C_1-C_{18} alkyl or hydroxyalkyl, or phenyl, or R^2 and R^3 together are a bridge of 3-6 methylene units, or R^2 and R^3 together with their ring atoms may be an aromatic ring system of 6-10 carbons, optionally substituted with one or more halo, lower alkyl, lower alkoxy, or amino groups;

R^5 is phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl, or a C_{5-7} aromatic or unsaturated or saturated heterocyclic ring having one to three heteroatoms selected from the group consisting of N, O and S; and

X^- is a pharmaceutically acceptable anion such as halide.

23. A compound of the formula:



wherein

R^1 is hydrogen, or –C(=O)–R^6 wherein R^6 is selected from the group consisting of C_1-C_{18} alkyl, C_1-C_{18} alkoxy, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl and naphthyl;

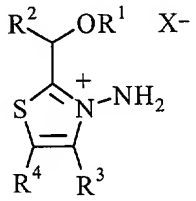
R^2 is hydrogen, phenyl or a C_{1-5} alkyl group;

R^3 and R^4 are independently selected from the group consisting of hydrogen, C_1-C_{18} alkyl or hydroxyalkyl, or phenyl, or R^3 and R^4 together are a bridge of 3-6 methylene units, or R^3 and R^4 together with their ring atoms may be an aromatic ring system of 6-10 carbons,

optionally substituted with one or more halo, lower alkyl, lower alkoxy, or amino groups; and

X^- is mesitylene-2-sulfonate or other pharmaceutically acceptable anion.

24. A pharmaceutical composition for administration to an animal, comprising a pharmaceutically effective amount of a compound selected from the group consisting of of formula



(Ic)

wherein

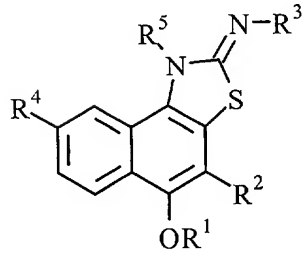
R^1 is hydrogen, or $-C(=O)-R^6$ wherein R^6 is selected from the group consisting of C_1-C_{18} alkyl, C_1-C_{18} alkoxy, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl and naphthyl;

R^2 is hydrogen, phenyl or a C_{1-5} alkyl group;

R^3 and R^4 are independently selected from the group consisting of hydrogen, C_1-C_{18} alkyl or hydroxyalkyl, or phenyl, or R^3 and R^4 together are a bridge of 3-6 methylene units, or R^3 and R^4 together with their ring atoms may be an aromatic ring system of 6-10 carbons, optionally substituted with one or more halo, lower alkyl, lower alkoxy, or amino groups; and

X^- is mesitylene-2-sulfonate or other pharmaceutically acceptable anion.

25. A compound of the formula of



wherein

R^1 is selected from the group consisting of H, C_{1-5} lower alkyl, C_{1-18} lower alkanoyl, and aroyl;

R^2 is selected from the group consisting of hydrogen and C_{1-6} lower alkyl;

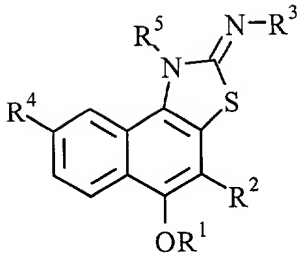
R^3 is selected from the group consisting of lower alkyl, C_3-C_8 cycloalkyl, phenyl, 1-[(aminoiminomethyl)hydrazono]ethyl substituted phenyl, naphthyl, or the aminoalkyl group –A–NR^6R^7 wherein A is a straight or branched alkanediyl linker of 1-6 carbons and R^6 and R^7 are independently selected from the group consisting of hydrogen, C_1-C_6 alkyl, or C_1-C_6 hydroxyalkyl, or R^6 and R^7 taken together with the nitrogen atom form a C_4-C_7 heterocyclic ring optionally containing one or two additional heteroatoms selected from the group consisting of N, O or sulfur;

R^4 is selected from the group consisting of hydrogen, acetyl and 1-[(aminoiminomethyl)-hydrazono]ethyl; and

R^5 is selected from the group consisting of hydrogen, C_1-C_6 alkyl, C_1-C_6 hydroxyalkyl, or aminoalkyl of structure –L–NR^8R^9 wherein L is a straight or branched alkanediyl linker of 1-6 carbons and R^8 and R^9 are independently selected from the group consisting of hydrogen, C_1-C_6 alkyl, C_1-C_6 hydroxyalkyl, or R^8 and R^9 taken together with the nitrogen atom form a C_4-C_7 heterocyclic ring optionally containing one or two additional heteroatoms selected from the group consisting of N, O or sulfur; with the proviso that if R^4 is hydrogen then R^5 is –L–NR^8N^9 as defined above;

or hydrochloride salts thereof, or other pharmaceutically acceptable salts thereof.

26. A pharmaceutical composition for administration to an animal, comprising a pharmaceutically effective amount of a compound selected from the group consisting of of formula



wherein

R^1 is selected from the group consisting of H, C_{1-5} lower alkyl, C_{1-18} lower alkanoyl, and aroyl;

R^2 is selected from the group consisting of hydrogen and C_{1-6} lower alkyl;

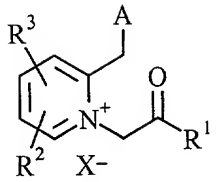
R^3 is selected from the group consisting of lower alkyl, C_3-C_8 cycloalkyl, phenyl, 1-[(aminoiminomethyl)hydrazono]ethyl substituted phenyl, naphthyl, or the aminoalkyl group –A–NR^6R^7 wherein A is a straight or branched alkanediyl linker of 1-6 carbons and R^6 and R^7 are independently selected from the group consisting of hydrogen, C_1-C_6 alkyl, or C_1-C_6 hydroxyalkyl, or R^6 and R^7 taken together with the nitrogen atom form a C_4-C_7 heterocyclic ring optionally containing one or two additional heteroatoms selected from the group consisting of N, O or sulfur;

R^4 is selected from the group consisting of hydrogen, acetyl and 1-[(aminoiminomethyl)-hydrazono]ethyl; and

R^5 is selected from the group consisting of hydrogen, C_1-C_6 alkyl, C_1-C_6 hydroxyalkyl, or aminoalkyl of structure –L–NR^8R^9 wherein L is a straight or branched alkanediyl linker of 1-6 carbons and R^8 and R^9 are independently selected from the group consisting of hydrogen, C_1-C_6 alkyl, C_1-C_6 hydroxyalkyl, or R^8 and R^9 taken together with the nitrogen atom form a C_4-C_7 heterocyclic ring optionally containing one or two additional heteroatoms selected from the group consisting of N, O or sulfur; with the proviso that if R^4 is hydrogen then R^5 is –L–NR^8N^9 as defined above;

or hydrochloride salts thereof, or other pharmaceutically acceptable salts thereof.

27. A compound of the formula



wherein

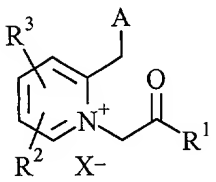
R^1 is selected from hydroxy, C_1-C_{18} alkoxy, amino optionally substituted with 1-2 independent C_1-C_{18} alkyl groups, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl, or a heterocyclyl group defined as a 5 to 10 membered aromatic or unsaturated or saturated heterocyclic system of 1-2 rings having one or more heteroatoms selected from the group consisting of N, O, or S;

A is selected from the group consisting of hydroxy, C_1-C_3 hydroxyalkyl, cyano, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl, a heterocyclyl group as defined for R^1 above with the proviso that the ring through which A is attached contains at least one heteroatom, or a group –C(=O)Z wherein Z is hydroxy, or Z is C_1-C_8 alkoxy, or Z is amino optionally substituted with 1-2 independent C_1-C_{18} alkyl groups, or Z is heterocyclyl as defined for R^1 above;

R^2 and R^3 are independently selected from hydrogen, amino, or C_1-C_{18} alkyl groups, or, if attached to adjacent ring positions, R^2 and R^3 taken together may form a carbocyclic or heterocyclic ring; and

X^- is halide, preferably chloride or bromide, or other pharmaceutically acceptable anion; and at least one of R^1 or A or Z is a heterocyclyl group as defined for the respective groups above.

28. A pharmaceutical composition for administration to an animal, comprising a pharmaceutically effective amount of a compound selected from the group consisting of of formula



wherein

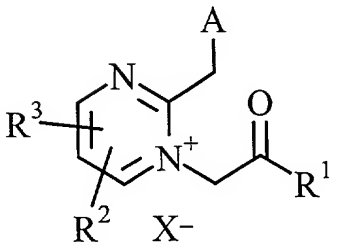
R^1 is selected from hydroxy, C_1-C_{18} alkoxy, amino optionally substituted with 1-2 independent C_1-C_{18} alkyl groups, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl, or a heterocyclyl group defined as a 5 to 10 membered aromatic or unsaturated or saturated heterocyclic system of 1-2 rings having one or more heteroatoms selected from the group consisting of N, O, or S;

A is selected from the group consisting of hydroxy, C_1-C_3 hydroxyalkyl, cyano, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl, a heterocyclyl group as defined for R^1 above with the proviso that the ring through which A is attached contains at least one heteroatom, or a group –C(=O)Z wherein Z is hydroxy, or Z is C_1-C_8 alkoxy, or Z is amino optionally substituted with 1-2 independent C_1-C_{18} alkyl groups, or Z is heterocyclyl as defined for R^1 above;

R^2 and R^3 are independently selected from hydrogen, amino, or C_1-C_{18} alkyl groups, or, if attached to adjacent ring positions, R^2 and R^3 taken together may form a carbocyclic or heterocyclic ring; and

X^- is halide, preferably chloride or bromide, or other pharmaceutically acceptable anion; and at least one of R^1 or A or Z is a heterocyclyl group as defined for the respective groups above.

29. A compound of formula



wherein

A is hydrogen, cyano, or a C_6-C_{10} aryl group, said aryl groups optionally substituted by one or more lower alkyl, lower alkoxy, or halo groups;

Z is CH or N;

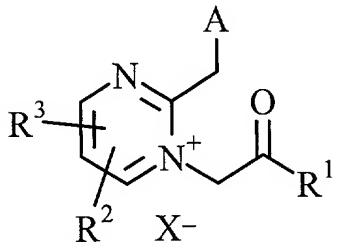
R^1 is hydroxy, C_1-C_{18} alkoxy, amino optionally substituted with 1-2 independent C_1-C_{18} alkyl groups, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl, naphthyl, or a 4 to 10 membered aromatic heterocyclic or unsaturated heterocyclic or saturated heterocyclic ring system of 1 to 2 rings having one to three heteroatoms selected from the group consisting of N, O and S;

R^2 and R^3 are independently selected from hydrogen, amino, or C_1-C_{18} alkyl groups, or R^2 and R^3 taken together may form a carbocyclic or heterocyclic ring, and

X^- is halide, preferably chloride or bromide, or other pharmaceutically acceptable anion;

and if A is hydrogen, then R^1 is selected from phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl, or a 4 to 10 membered aromatic heterocyclic or unsaturated heterocyclic or saturated heterocyclic ring system of 1 to 2 rings having one to three heteroatoms selected from the group consisting of N, O and S.

30. A pharmaceutical composition for administration to an animal, comprising a pharmaceutically effective amount of a compound selected from the group consisting of of formula



wherein

A is hydrogen, cyano, or a C_6-C_{10} aryl group, said aryl groups optionally substituted by one or more lower alkyl, lower alkoxy, or halo groups;

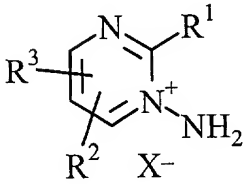
Z is CH or N;

R^1 is hydroxy, C_1-C_{18} alkoxy, amino optionally substituted with 1-2 independent C_1-C_{18} alkyl groups, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl, naphthyl, or a 4 to 10 membered aromatic heterocyclic or unsaturated heterocyclic or saturated heterocyclic ring system of 1 to 2 rings having one to three heteroatoms selected from the group consisting of N, O and S;

R^2 and R^3 are independently selected from hydrogen, amino, or C_1-C_{18} alkyl groups, or R^2 and R^3 taken together may form a carbocyclic or heterocyclic ring, and

X^- is halide, preferably chloride or bromide, or other pharmaceutically acceptable anion; and if A is hydrogen, then R^1 is selected from phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl, or a 4 to 10 membered aromatic heterocyclic or unsaturated heterocyclic or saturated heterocyclic ring system of 1 to 2 rings having one to three heteroatoms selected from the group consisting of N, O and S.

31. A compound of formula



wherein

R^1 is selected from:

amino,

methyl,

cyanomethyl,

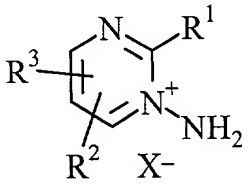
the group $-CH_2-A$ where A is a C_6-C_{10} aryl group optionally substituted by one or more lower alkyl, lower alkoxy or halo groups, or

the group $-CH_2-C(=O)-Z$ where Z is selected from hydroxy, C_1-C_{18} alkoxy, amino optionally substituted with 1-2 C_1-C_{18} alkyl groups, a C_6-C_{10} aryl group optionally substituted by one or more lower alkyl or halo groups, or a 4 to 10 membered aromatic heterocyclic or unsaturated heterocyclic or saturated heterocyclic ring system of 1 to 2 rings having one to three heteroatoms selected from the group consisting of N, O and S;

R^2 and R^3 are independently selected from hydrogen, amino, C_1-C_6 alkoxy, or C_1-C_8 alkyl groups, or if R^2 and R^3 are on adjacent atoms then R^2 and R^3 taken together with their ring atoms may form a fused carbocyclic or heterocyclic ring; and

X^- is mesitylene-2-sulfonate or other pharmaceutically acceptable anion.

32. A pharmaceutical composition for administration to an animal, comprising a pharmaceutically effective amount of a compound selected from the group consisting of of formula



wherein

R^1 is selected from:

amino,

methyl,

cyanomethyl,

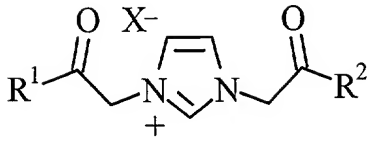
the group $-CH_2-A$ where A is a C_6-C_{10} aryl group optionally substituted by one or more lower alkyl, lower alkoxy or halo groups, or

the group $-CH_2-C(=O)-Z$ where Z is selected from hydroxy, C_1-C_{18} alkoxy, amino optionally substituted with 1-2 C_1-C_{18} alkyl groups, a C_6-C_{10} aryl group optionally substituted by one or more lower alkyl or halo groups, or a 4 to 10 membered aromatic heterocyclic or unsaturated heterocyclic or saturated heterocyclic ring system of 1 to 2 rings having one to three heteroatoms selected from the group consisting of N, O and S;

R^2 and R^3 are independently selected from hydrogen, amino, C_1-C_6 alkoxy, or C_1-C_8 alkyl groups, or if R^2 and R^3 are on adjacent atoms then R^2 and R^3 taken together with their ring atoms may form a fused carbocyclic or heterocyclic ring; and

X^- is mesitylene-2-sulfonate or other pharmaceutically acceptable anion.

33. A compound of the formula

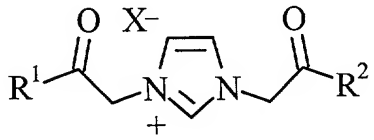


wherein

R^1 and R^2 are independently selected from hydroxy, C_1-C_{18} alkoxy, amino optionally substituted with 1-2 independent alkyl groups of 1-8 carbons, aryl, halosubstituted aryl, (lower alkyl)substituted aryl, or a heterocyclyl group defined as a 4 to 10 membered aromatic heterocyclic or unsaturated heterocyclic or saturated heterocyclic ring system of 1 to 2 rings having one to three heteroatoms selected from the group consisting of N, O and S, with the proviso that one of R^1 or R^2 must be an optionally substituted amino group or heterocyclyl group as defined above; and

X^- is halide, preferably chloride or bromide, or other pharmaceutically acceptable anion.

34. A pharmaceutical composition for administration to an animal, comprising a pharmaceutically effective amount of a compound selected from the group consisting of of formula

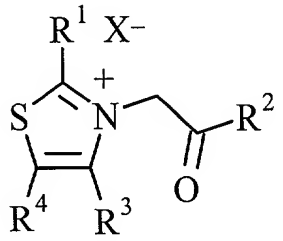


wherein

R^1 and R^2 are independently selected from hydroxy, C_1-C_{18} alkoxy, amino optionally substituted with 1-2 independent alkyl groups of 1-8 carbons, aryl, halosubstituted aryl, (lower alkyl)substituted aryl, or a heterocyclyl group defined as a 4 to 10 membered aromatic heterocyclic or unsaturated heterocyclic or saturated heterocyclic ring system of 1 to 2 rings having one to three heteroatoms selected from the group consisting of N, O and S, with the proviso that one of R^1 or R^2 must be an optionally substituted amino group or heterocyclyl group as defined above; and

X^- is halide, preferably chloride or bromide, or other pharmaceutically acceptable anion.

35. A method comprising in vivo treating of a target biomaterial with an effective amount of a composition to improve the biomechanical and diffusional characteristics of the biomaterial, wherein the composition comprises a compound selected from the group consisting of compounds of the formula (I):



(I)

wherein R^1 is a C_1-C_{18} alkyl group, or the group $-CH(R^5)-OH$, or the group $-CH(R^5)-OC(=O)-R^6$ wherein R_5 is a C_{1-18} alkyl group and R_6 is selected from the group consisting of C_1-C_{18} alkyl, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl and naphthyl;

R_2 is selected from the group consisting of hydroxy, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl, a C_{5-7} aromatic, unsaturated or saturated heterocyclic ring having one to three heteroatoms selected from the group consisting of N, O and S;

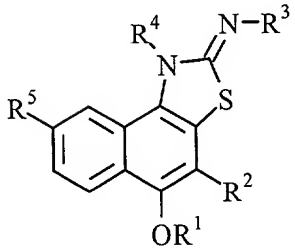
R_3 and R_4 are independently selected from the group consisting of hydrogen, C_1-C_{18} alkyl or hydroxyalkyl, or phenyl, or R_3 and R_4 together are a bridge of 3-6 methylene units, or R_3 and R_4 together with their ring atoms may be an aromatic ring system of 6-10 carbons, optionally substituted with one or more halo, lower alkyl, lower alkoxy, or amino groups; and

X^- is halide or other pharmaceutically acceptable anion.

36. The method of claim 35 wherein the effective amount is sufficient to return the biomechanical and diffusional characteristics of the biomaterial to the state found in a healthy 20 year old human.

37. A method comprising in vivo treating of a target biomaterial with an effective amount of a composition to improve the biomechanical and diffusional characteristics of the biomaterial,

wherein the composition comprises a compound selected from the group consisting of compounds of the formula (II):



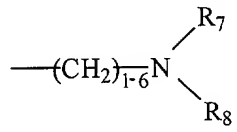
(II)

wherein

R^1 is selected from the group consisting of H, C_{1-5} lower alkyl, C_{1-18} lower alkanoyl, and aroyl;

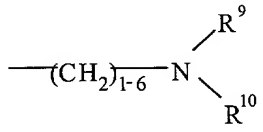
R^2 is selected from the group consisting of hydrogen and C_{1-5} lower alkyl;

R^3 is selected from the group consisting of lower alkyl, C_3-C_8 cycloalkyl, phenyl, 1-[(aminoiminomethyl)hydrazono]ethyl substituted phenyl, naphthyl, or aminoalkyl of the structure



wherein R^7 and R^8 are independently selected from the group consisting of hydrogen, C_1-C_6 alkyl, C_1-C_6 hydroxyalkyl, or R^7 and R^8 taken together with the nitrogen atom form a C_4-C_7 heterocyclic ring optionally containing one or two additional heteroatoms selected from the group consisting of N, O or sulfur;

R^4 is selected from the group consisting of methyl, lower alkyl, or aminoalkyl of structure



wherein R^9 and R^{10} are independently selected from the group consisting of hydrogen, C_1-C_6 alkyl, C_1-C_6 hydroxyalkyl, or R^9 and R^{10} taken together with the nitrogen

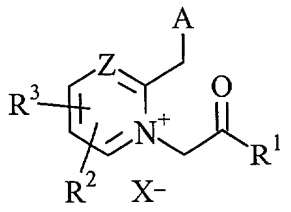
atom form a C_4-C_7 heterocyclic ring optionally containing one or two additional heteroatoms selected from the group consisting of N, O or sulfur; and

R^5 is selected from the group consisting of hydrogen, acetyl and 1-[(aminoiminomethyl)-hydrazono]ethyl;

or hydrochloride salts thereof, or other pharmaceutically acceptable salts thereof.

38. The method of claim 37 wherein the effective amount is sufficient to return the biomechanical and diffusional characteristics of the biomaterial to the state found in a healthy 20 year old human.

39. A method comprising in vivo treating of a target biomaterial with an effective amount of a composition to improve the biomechanical and diffusional characteristics of the biomaterial, wherein the composition comprises a compound selected from the group consisting of compounds of the formula (III):



(III)

wherein

A is hydrogen, cyano, or a C_6-C_{10} aryl group, said aryl groups optionally substituted by one or more lower alkyl, lower alkoxy, or halo groups;

Z is CH or N;

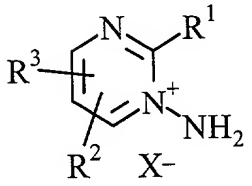
R^1 is hydroxy, C_1-C_{18} alkoxy, amino optionally substituted with 1-2 independent C_1-C_{18} alkyl groups, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl, or a C_{4-7} aromatic or unsaturated or saturated heterocyclic ring having one to three heteroatoms selected from the group consisting of N, O, or S, with the proviso that at least one heteroatom is nitrogen and said nitrogen is directly bonded to the carbonyl group; and

R^2 and R^3 are independently selected from hydrogen, amino, or C_1-C_{18} alkyl groups, or R^2 and R^3 taken together may form a carbocyclic or heterocyclic ring, and

X^- is halide, or other pharmaceutically acceptable anion.

40. The method of claim 39 wherein the effective amount is sufficient to return the biomechanical and diffusional characteristics of the biomaterial to the state found in a healthy 20 year old human.

41. A method comprising in vivo treating of a target biomaterial with an effective amount of a composition to improve the biomechanical and diffusional characteristics of the biomaterial, wherein the composition comprises a compound selected from the group consisting of compounds of the formula (IV):



(IV)

wherein R^1 is selected from:

amino,

methyl,

cyanomethyl,

the group $-CH_2-A$ where A is a C_6-C_{10} aryl group optionally substituted by one or more lower alkyl, lower alkoxy or halo groups, or

the group $-CH_2-C(=O)-Z$ where Z is selected from hydroxy, C_1-C_{18} alkoxy, amino optionally substituted with 1-2 C_1-C_{18} alkyl groups, a C_6-C_{10} aryl group optionally substituted by one or more lower alkyl or halo groups, or a C_{4-7} aromatic or unsaturated or saturated heterocyclyl group having one to three heteroatoms selected from the group consisting of N, O, or S;

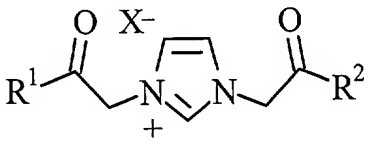
R^2 and R^3 are independently selected from hydrogen, amino, lower alkoxy, or C_1-C_8 alkyl groups, or if R^2 and R^3 are on adjacent atoms then R^2 and R^3 taken together with their ring atoms may form a fused carbocyclic or heterocyclic ring; and

X^- is mesitylene-2-sulfonate or other pharmaceutically acceptable anion.

42. The method of claim 41 wherein the effective amount is sufficient to return the biomechanical and diffusional characteristics of the biomaterial to the state found in a healthy 20 year old human.

43. A method comprising in vivo treating of a target biomaterial with an effective amount of

a composition to improve the biomechanical and diffusional characteristics of the biomaterial, wherein the composition comprises a compound selected from the group consisting of compounds of the formula (V):



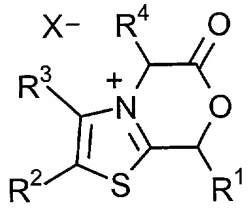
(V)

wherein

R^1 and R^2 are independently selected from hydroxy, lower alkoxy, amino optionally substituted with 1-2 lower alkyl groups, aryl, halosubstituted aryl, (lower alkyl)substituted aryl, or a C_{5-7} unsaturated or saturated heterocyclic ring having one to three heteroatoms selected from the group consisting of N, O, and S and X^- is halide, or other pharmaceutically acceptable anion.

44. The method of claim 43 wherein the effective amount is sufficient to return the biomechanical and diffusional characteristics of the biomaterial to the state found in a healthy 20 year old human.

45. A method comprising in vivo treating of a target biomaterial with an effective amount of a composition to improve the biomechanical and diffusional characteristics of the biomaterial, wherein the composition comprises a compound selected from the group consisting of compounds of the formula:



wherein

R^1 and R^4 are independently selected from hydrogen, phenyl or C_1-C_5 alkyl;

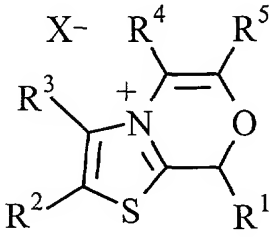
R^2 and R^3 are independently selected from the group consisting of hydrogen, C_1-C_{18} alkyl or hydroxyalkyl, or phenyl, or R^2 and R^3 together are a bridge of 3-6 methylene units, or R^2 and R^3 together with their ring atoms may be an aromatic ring system of 6-10 carbons,

optionally substituted with one or more halo, lower alkyl, lower alkoxy, or amino groups; and

X^- is a pharmaceutically acceptable anion such as halide.

46. The method of claim 45 wherein the effective amount is sufficient to return the biomechanical and diffusional characteristics of the biomaterial to the state found in a healthy 20 year old human.

47. A method comprising in vivo treating of a target biomaterial with an effective amount of a composition to improve the biomechanical and diffusional characteristics of the biomaterial, wherein the composition comprises a compound selected from the group consisting of compounds of the formula:



wherein

R^1 and R^4 are independently selected from hydrogen, phenyl or C_1-C_5 alkyl;

R^2 and R^3 are independently selected from the group consisting of hydrogen, C_1-C_{18} alkyl or hydroxyalkyl, or phenyl, or R^2 and R^3 together are a bridge of 3-6 methylene units, or R^2 and R^3 together with their ring atoms may be an aromatic ring system of 6-10 carbons, optionally substituted with one or more halo, lower alkyl, lower alkoxy, or amino groups;

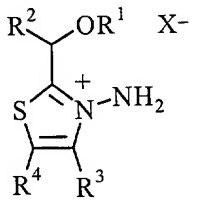
R^5 is phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl, or a C_{5-7} aromatic or unsaturated or saturated heterocyclic ring having one to three heteroatoms selected from the group consisting of N, O and S; and

X^- is a pharmaceutically acceptable anion such as halide.

48. The method of claim 47 wherein the effective amount is sufficient to return the biomechanical and diffusional characteristics of the biomaterial to the state found in a healthy 20 year old human.

49. A method comprising in vivo treating of a target biomaterial with an effective amount of a composition to improve the biomechanical and diffusional characteristics of the biomaterial,

wherein the composition comprises a compound selected from the group consisting of compounds of the formula:



wherein

R^1 is hydrogen, or $-C(=O)-R^6$ wherein R^6 is selected from the group consisting of C_1-C_{18} alkyl, C_1-C_{18} alkoxy, phenyl, halosubstituted phenyl, C_1-C_{18} alkoxysubstituted phenyl and naphthyl;

R^2 is hydrogen, phenyl or a C_{1-5} alkyl group;

R^3 and R^4 are independently selected from the group consisting of hydrogen, C_1-C_{18} alkyl or hydroxyalkyl, or phenyl, or R^3 and R^4 together are a bridge of 3-6 methylene units, or R^3 and R^4 together with their ring atoms may be an aromatic ring system of 6-10 carbons, optionally substituted with one or more halo, lower alkyl, lower alkoxy, or amino groups; and

X^- is mesitylene-2-sulfonate or other pharmaceutically acceptable anion.

50. The method of claim 49 wherein the effective amount is sufficient to return the biomechanical and diffusional characteristics of the biomaterial to the state found in a healthy 20 year old human.

51. The method of claim 35 wherein the effective amount is sufficient to improve the biomechanical and diffusional characteristics of the biomaterial by at least about a 20% uncoupling activity after 1 day as measured by Assay of Uncoupling Activity test method.

52. The method of claim 37 wherein the effective amount is sufficient to improve the biomechanical and diffusional characteristics of the biomaterial by at least about a 20% uncoupling activity after 1 day as measured by Assay of Uncoupling Activity test method.

53. The method of claim 39 wherein the effective amount is sufficient to improve the biomechanical and diffusional characteristics of the biomaterial by at least about a 20% uncoupling activity after 1 day as measured by Assay of Uncoupling Activity test method.

54. The method of claim 41 wherein the effective amount is sufficient to improve the biomechanical and diffusional characteristics of the biomaterial by at least about a 20% uncoupling activity after 1 day as measured by Assay of Uncoupling Activity test method.

55. The method of claim 43 wherein the effective amount is sufficient to improve the biomechanical and diffusional characteristics of the biomaterial by at least about a 20% uncoupling activity after 1 day as measured by Assay of Uncoupling Activity test method.

56. The method of claim 45 wherein the effective amount is sufficient to improve the biomechanical and diffusional characteristics of the biomaterial by at least about a 20% uncoupling activity after 1 day as measured by Assay of Uncoupling Activity test method.

57. The method of claim 47 wherein the effective amount is sufficient to improve the biomechanical and diffusional characteristics of the biomaterial by at least about a 20% uncoupling activity after 1 day as measured by Assay of Uncoupling Activity test method.

58. The method of claim 49 wherein the effective amount is sufficient to improve the biomechanical and diffusional characteristics of the biomaterial by at least about a 20% uncoupling activity after 1 day as measured by Assay of Uncoupling Activity test method.

59. A compound selected from the group consisting of 1,2-dihydro-1-[3-(dimethylamino)propyl]-4-methyl-2-(phenylimino)naphtho[1,2-*d*]thiazol-5-ol; 2-(cyclohexylimino)-1,2-dihydro-4-methyl-1-[3-(4-morpholino)propyl]naphtho[1,2-*d*]thiazol-5-ol; 2-[[3-(dimethylamino)propyl]imino]-1,2-dihydro-1,4-dimethylnaphtho[1,2-d]thiazol-5-ol; 2-(cyclohexylimino)-1,2-dihydro-4-methyl-1-[3-(dimethylamino)propyl]naphtho[1,2-*d*]thiazol-5-ol, and pharmaceutically acceptable salts thereof.

60. A compound of 1-[2-(1-pyrrolidinyl)-2-oxoethyl]-2-(cyanomethyl)pyridinium and pharmaceutically acceptable salts thereof

61. A compound of 5,6-dihydro-8-methyl-6-oxo-8*H*-thiazolo[2,3-*c*](1,4)oxazin-4-ium and pharmaceutically acceptable salts thereof.